Detecting benthic macroinvertebrate assemblage characteristics using quantitative sampling

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Streams draining valley fills often have elevated salinity.

Appalachian MTM/VF
Specific Conductance (SC)

- Proxy for salinity/TDS
- Associated with composition of benthic macroinvertebrate assemblages
- In-stream data loggers record SC in 15 min intervals → Long-term trends
Quantitative sampling

1. Well-defined, precise and known sample area
2. Hess sampler collects only those organisms within the sampler

Lab
Count and identify the entire sample
Density = # individuals/area

Supplement assessment with density data

In addition to composition, density can:

1. Detect how close population is to extirpation
2. Suggest possible diminished ability of population to provide ecosystem services
Objectives

Quantitative sampling

Density vs. SC

Assessment of Stream Health (Bioassessment)

Test response of density to SC

Additional information??
Questions

1. Is there a significant response between benthic macroinvertebrate density and a gradient of SC?

2. Do extremely dominant and tolerant taxa mask the relationship between more sensitive groups and SC?
Site selection criteria

1. Same ecoregion
   - U.S. EPA region 69d
2. Gradient of (SC)
   - Approx. 20 - 1900 µS/cm

3 Reference streams (blue squares)
9 mining-influenced streams (yellow circles)

3. Similar habitat

Reference

Mine-influenced
Groups

EPT
Ephemeroptera
Plecoptera
Trichoptera

Functional Feeding Groups
Shredders
Filterers
Gatherers
Scrapers
Predators

Habit
Clingers
Sprawlers
Swimmers
Burrowers

Total Taxa
Question 1: Is there a significant response between benthic macroinvertebrate density and a gradient of SC?

Spearman correlations (p < 0.05)

Data:
Spring (May 2013)
## Spring list of significantly* correlated (w/SC) groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Spearman r</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (w/o Baetidae)</td>
<td>-0.793</td>
</tr>
<tr>
<td>Leuctra</td>
<td>0.692</td>
</tr>
<tr>
<td>Shredders</td>
<td>0.692</td>
</tr>
<tr>
<td>Plecoptera</td>
<td>0.683</td>
</tr>
<tr>
<td>Sprawlers</td>
<td>0.671</td>
</tr>
<tr>
<td>Total Density</td>
<td>0.664</td>
</tr>
<tr>
<td>EPT</td>
<td>0.636</td>
</tr>
</tbody>
</table>

*p < 0.05
Ephemeroptera (w/o Baetidae)

1. Drop in density at around 450-600 $\mu$S/cm
2. What density can show us:

Diminished density $\approx$ diminished ability to provide ecosystem services?
Ephemeroptera

Density (inds/m²) vs. SC (µS/cm)

- with Baetidae
- w/o Baetidae

The graph shows a negative correlation between density and SC, with data points for 'with Baetidae' and 'w/o Baetidae' distinctly separated.
Leuctra

Up to 80% of total density!
2. Do extremely dominant and tolerant taxa mask the relationship between more sensitive groups and SC?

**YES**
Total Density

Total w/o Leuctra

Density (inds/m²)

SC (µS/cm)

May 2013

YES
w/o Leuctra → diminished shredder population

YES
Leuctra density and pattern across time
Results

Tolerant taxa density

With Leuctra

w/o Leuctra

Sensitive taxa density

diminished shredders

Conclusions
The conclusions about the given group rely on the decision to keep the tolerant taxon in the analyses, or to take them out.
Summary

1. Density can detect potential loss of taxa
   - e.g. Ephemeroptera, Shredders
   - Implies diminished ability to perform functions

2. Assessors should be aware that tolerant and influential taxa can obscure other results
   - e.g. stream assessment interpretation

These are both examples of information that can supplement assessments of stream health
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Thank You

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